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TITLE: Prepn. of fibre-reinforced composite prod. - by injection moulding reactive material contg. at least two components into mould cavity contg. oriented textile layers

PATENT-ASSIGNEE:

ASSIGNEE

KOBÉ STEEL LTD

CODE

KOBM

PRIORITY-DATA: 1991JP-0237203 (August 23, 1991)

PATENT-FAMILY:

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JP 05050433 A	March 2, 1993		004	B29B011/16
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APPLICATION-DATA:

PUB-NO	APPL-DATE	APPL-NO	DESCRIPTOR
JP 05050433A	August 23, 1991	1991JP-0237203	
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JP 95090553B2		JP 5050433	Based on

INT-CL (IPC): B29B 11/16; B29B 15/08; B29C 45/14; B29K 105/08

ABSTRACTED-PUB-NO: JP 05050433A

BASIC-ABSTRACT:

The prod. is prepd. by injection moulding a reactive composite material comprising at least 2 liquid components into the cavity of a mould contg. 2-10 textile layers comprising oriented strands having a strand density of 10-25 strands/25 mm, each laminated so that a textile layer crosses with the vicinal textile layer at 10-90 deg. The laminated layers are knitted with knitted strings in a density of 2-10 strings/25.

USE/ADVANTAGE - Higher bending strength. Used as parts of motor cars or housing of electronic devices and electrical insulating materials.

In an example, a mould was set with 2 multiply glass fibre layers each comprising 4 layers each crossed at 0 deg./+45 deg./45 deg./90 deg. and each having a basis wt. of 2300 g/m², 17 strands/25 mm and knitted with 6 strands/25mm. The mould was then injected with epoxy resin and a hardening in a wt. ratio of 112 g/30 g at a rate of 142 g/sec. through a reactive injection moulding machine of piston/cylinder type. The resin was cured at 130 deg.C for 5 minutes. The composite product contains 78 wt.% fibre, a bending strength of 79.5 kgf/mm² and Izod impact strength of 300 kg.cm/c

CHOSEN-DRAWING: Dwg.0/1

TITLE-TERMS: PREPARATION FIBRE REINFORCED COMPOSITE PRODUCT INJECTION MOULD REACT MATERIAL CONTAIN TWO COMPONENT MOULD CAVITY CONTAIN ORIENT TEXTILE LAYER

DERWENT-CLASS: A32 A85 A95 L03

CPI-CODES: A08-R01; A11-B09A1; A11-B12A; A12-E01; A12-S08D2; A12-S08D3; A12-T04; L03-A;

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DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[Industrial Application] Since the content of strengthening fiber is highly excellent in the dynamic property, the fiber strengthening composite material manufactured by this invention method can be widely used for the field as which specific strength is required.

[0002]

[Description of the Prior Art] the metal mold after mixing two or more sorts of liquefied raw materials in recent years in fields, such as road transport department material, and housing material for electronic equipment, electric insulation material, -- the inside of a mold cavity -- pouring in -- this -- metal mold -- the reaction injection molding (henceforth the RIM method) which obtains a Plastic solid is broadly used by carrying out reaction hardening inside Moreover, it is beforehand filled up with reinforcement fiber in the mold cavity, and by carrying out pouring / reaction hardening of the above-mentioned mixed liquor object, by obtaining the mold goods which were excellent in the dynamic property with the comparatively short cycle, the reaction injection molding for structures (henceforth the S-RIM method) which obtains a composite attracts attention as the forming method of a new composite material replaced with a hand lay up method, and is being put in practical use.

[0003] The outline of the S-RIM method is shown in drawing 1. The reactant liquefied raw materials 4 and 5 paid to the tank 1 in operation are made to breathe out simultaneously, within mixed equipment 2, the mixed liquor which was made to carry out collision mixture and was obtained is poured in into the metal mold 3 beforehand filled up with the reinforcement, and carries out heat hardening, and composite material is obtained.

[0004] The dynamic property of the composite material obtained by the above-mentioned method is governed by especially the content of a reinforcement mainly depending on the reinforcement and resin which are used. Therefore, it is important to make content of a reinforcement high. however, metal mold -- the flow resistance by the reinforcement at the time of introducing a reactant resin raw material, when the pack density of the inner charge of a reinforcement is high -- large -- becoming -- metal mold -- the poor wet of movement of the reinforcement inside or the resin to a reinforcement is caused Then, although the flow resistance at the time of resin raw material pouring was lowered and the above-mentioned problem was conventionally solved by lowering the pack density of a reinforcement or using reinforcements with small fiber density (random fiber mat etc.), with these solutions, the dynamic property of mold goods cannot but become a low thing inevitably.

[0005]

[Problem(s) to be Solved by the Invention] It is going to be made in view of the above situations, and this invention does not lower a flow resistance according to the kind of reinforcement, but by devising the array structure, by stopping a flow resistance low, its content of a reinforcement is high, therefore it tends to offer the method of manufacturing the charge of a fiber reinforcement which was excellent in the dynamic property.

[0006]

[Means for Solving the Problem] In the reaction injection molding for structures which obtains composite material by mixing, pouring in and carrying out reaction hardening of two or more sorts of liquefied raw materials inside the metal mold with which, as for the manufacture method of the charge of a fiber reinforcement of this invention which was able to solve the above-mentioned technical problem, it filled up with the reinforcement beforehand -- Strand density : while carrying out a 2-10-layer laminating so that the crossed axes angle whose fiber ***** direction in the fiber layer which adjoins the fiber layer which consists of a fiber group lengthened and arranged by 10-25 / 25mm is 10 - 90 degrees may be made A summary is to carry out injection molding using what held these by 2-10 / knitting density of 25mm using knitting thread, and constituted the reinforcement layer.

[0007]

[Function] The reinforcement content at the time of manufacturing composite material by the conventional S-RIM method was 30 - 50 % of the weight at the maximum. On the other hand, in this invention, by specifying the array structure of a reinforcement, the flow resistance by the reinforcement was stopped low and it succeeded in raising the content of a reinforcement to 70% of the weight or more. It explains in more detail below.

[0008] The many laminated materials which held the layer of the fiber group lengthened and arranged as many laminated materials used as a reinforcement by knitting are used. The lap section of fiber like the usual textiles or knitting, and fiber (crimp) By this invention, although the fluidity of a resin was suppressed by the part and the flow resistance increased when what exists

was used, since the fiber layer (non-crimp type nonwoven fabric) which laps and does not have the section was used, checking a flow of a resin in the lap section is lost, and the content of a reinforcement could be raised. In addition, it is necessary to control strand density to be set to 10-25 / 25mm at this time. When strand density is too low, the fiber content of mold goods is low, as a result, the dynamic property also becomes low, and in being too high, the flow resistance of a resin becomes large, and the poor wet of movement of a reinforcement or the resin to a reinforcement is caused. In addition, although the total denier of fiber changes also with materials to be used, in the case of a glass fiber, it is desirable that they are 200-3000d, for example. Moreover, the diameter is 0.3mm. It is desirable that it is the following.

[0009] In carrying out the laminating of the above-mentioned fiber layer, an angle is changed and carries out a laminating. It is necessary to carry out the laminating of the change of an angle so that the **** fiber ***** direction by which the laminating was carried out may cross at 10 - 90 degrees mutually. While maintenance of a configuration becomes easy by carrying out the laminating of the degree of crossed axes angle at 10 - 90 degrees, the on-the-strength change in the horizontal direction of the composite material obtained can be suppressed low.

[0010] Next, although each class is connected in one by knitting and held, it is necessary to control the density of the knitting thread at that time to 2-10 / 25mm. By the fiber of a fiber layer becoming easy to be confused when density is too low, in being too high, the flow resistance of a resin becomes large and it causes problems, such as un-sinking [of the resin to a reinforcement] in.

[0011] In addition, the reinforcement used for this invention and especially the material of knitting thread are not limited, can be used, combining suitably well-known strengthening fiber and those mixture, such as a glass fiber, and a carbon fiber, an aramid fiber, and especially the configuration is not limited, either but they can also use any of a continuous glass fiber and a staple fiber. Especially a matrix material is not limited, either but it can choose from an epoxy resin, phenol resin, an unsaturated polyester resin, etc. suitably that what is necessary is just the thing which mixes two or more sorts of liquefied raw materials, and is made to carry out reaction hardening.

[0012] Moreover, it not only uses the non-lap type multi-laminating glass fiber fabric of this invention independently, but it can use it, combining suitably the reinforcement of various gestalten, such as textiles, knitting, and a nonwoven fabric.

[0013] Although this invention is further explained in full detail according to an example below, the following example does not restrict this invention and all the things done for change implementation in the range which does not deviate from before and the after-mentioned meaning are included by the technical range of this invention.

[0014]

[Example]

A reaction-injection-molding machine (refer to drawing 1) examples 1 and 2, the example 1 of comparison - 3 example 1 piston-cylinder type is used. the laminating of two sheet] was beforehand carried out for the thing (6[4 layers (each angle of 0 degree / +45 degrees / -45 degrees / 90 degrees) of non-lap type multi-laminating glass fiber fabrics, amount of eyes:2300 g/m², fiber strand density:1725mm / knitting thread density:625mm) into metal mold 3 142g/second in speed after carrying out measurement liquid sending and carrying out collision mixture in the mixed equipment section 2, adjusting the epoxy resin 4 and curing agent 5 in a tank 1 so that it may become the ratio of 112:30 (g) -- metal mold -- it breathed out inside It fabricated on the die temperature of 130 degrees C, and the conditions for cycle-time 5 minutes after that.

[0015] Using the same making machine as example 2 example 1, one continuous-fiber mat (the amount of eyes : 300 g/m²) was further inserted between two multi-laminating textiles of the same specification, and it fabricated on the same conditions.

[0016] It fabricated like the example 1 except having considered as the example of comparison 1 non-lap type multi-laminating glass fiber fabric, and having used the thing (fiber strand density:3025mm / knitting thread density:1525mm).

[0017] Eight plain weave glass fiber fabrics (the amount of eyes : 330 g/m², strand density : passing 16 / 25mm, 14 ** / 25mm) were fabricated like the example 1 instead of the example of comparison 2 non-lap type multi-laminating glass fiber fabric except having carried out the laminating and having used.

[0018] The continuation glass fiber mat (the amount of eyes : 300 g/m²) was fabricated like the example 1 instead of the example of comparison 3 non-lap type multi-laminating glass fiber fabric except having carried out the six-sheet laminating and having used.

[0019] the metal mold at the time of forming as mentioned above -- the impregnating ability of an inner resin and the dynamic characterization result of each mold goods are shown in Table 1 In addition, evaluation of a dynamic property was performed as follows.

* Flexural strength : JIS K-7055* bending elastic modulus : JIS K-7055* Izod impactive strength: JIS K-7110 [0020]

[Table 1]

	実施例 1	実施例 2	比較例 1	比較例 2	比較例 3
樹脂含浸性	良	良	不良	不良	良
繊維含有率 (重量%)	78	75	—	—	39
曲げ強度 (kgf/mm ²)	79.5	76.1	—	—	31.0
曲げ弾性率 ($\times 10^3$ kgf/mm ²)	3300	3100	—	—	992
アイゾット衝撃強度 (kg·cm/cm ²)	300	285	—	—	—

[0021] Composite material with the impregnating ability of a resin good [examples 1 and 2] as shown in a table, and fiber content higher than before was obtained. Therefore, the material which was very excellent also in dynamic properties, such as flexural strength, was obtained. On the other hand, since the example 1 of comparison has strand density and high knitting density, and since the example 2 of comparison used the plain weave fabric, the impregnating ability of a resin was bad, a poor wet was not able to be caused and a uniform composite material was not able to be obtained. Moreover, the example 3 of comparison was not what the dynamic property excelled in fiber content not much for the low reason, although the impregnating ability of a resin was good.

[0022]

[Effect of the Invention] this invention is constituted as mentioned above, and can raise the impregnating ability of a resin by limiting the structure of a reinforcement, as a result can raise fiber content now. Therefore, the composite material obtained is excellent in dynamic properties, such as flexural strength.

[Translation done.]

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CLAIMS

[Claim(s)]

[Claim 1] In the structure reaction injection molding which obtains composite material by mixing, pouring in and carrying out reaction hardening of two or more sorts of liquefied raw materials inside the metal mold with which it filled up with the reinforcement beforehand -- Strand density : while carrying out a 2-10-layer laminating so that the crossed axes angle whose fiber ***** direction in the fiber layer which adjoins the fiber layer which consists of a fiber group lengthened and arranged by 10-25 / 25mm is 10 - 90 degrees may be made The manufacture method of the fiber strengthening composite material characterized by carrying out injection molding using what held these by 2-10 / knitting density of 25mm using knitting thread, and constituted the reinforcement layer.

[Translation done.]